UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	684.2846
First Named Inventor or Application Identifier	
KAZUNORI IWAMOTO, ET AL.	
Express Mail Label No.	

JC518 U.S. PTO 09/323034 06/01/99

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

JC490 U.S. PTO 06/01/99

1. [X] Fee Transmittal Form *(Submit an original, and a duplicate for fee processing)*
2. [X] Specification *Total Pages* 23
3. [X] Drawing(s) *(35 USC 113)* *Total Sheets* 4
4. [X] Oath or Declaration *Total Pages* 2
   - a. [ ] Newly executed (original or copy)
   - b. [X] Unexecuted for information purposes
   - c. [ ] Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 17 completed)* ***[Note Box 5 below]***
     - i. [ ] DELETION OF INVENTOR(S) Signed Statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. [ ] Incorporation By Reference *(useable if Box 4c is checked)* The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4c, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [ ] Microfiche Computer Program *(Appendix)*
7. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   - a. [ ] Computer Readable Copy
   - b. [ ] Paper Copy (identical to computer copy)
   - c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. [ ] Assignment Papers (cover sheet & documents)
9. [ ] 37 CFR 3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
14. [ ] Small Entity Statement(s) [ ] Statement filed in prior application Status still proper and desired
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [ ] Other: ____________________

17. If a CONTINUING APPLICATION, *check appropriate box and supply the requisite information:*

[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No. ___/__________

18. CORRESPONDENCE ADDRESS

[X] Customer Number or Bar Code Label — 05514 (Insert Customer No. or Attach bar code label here) — or [ ] Correspondence address below

NAME					
Address					
City		State		Zip Code	
Country		Telephone		Fax	

CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 CFR 1.16(c))	26-20 =	6	X $ 18.00 =	$ 108.00
	INDEPENDENT CLAIMS (37 CFR 1.16(b))	3-3 =	0	X $ 78.00 =	$ 00.00
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))			$260.00 =	$ 260.00
				BASIC FEE (37 CFR 1.16(a))	$ 760.00
			Total of above Calculations =		$1128.00
	Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28).				
				TOTAL =	$1128.00

19. Small entity status

a. ☐ A Small entity statement is enclosed

b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.

c. ☐ Is no longer claimed.

20. ☒ A check in the amount of $ 1128.00 ______ to cover the filing fee is enclosed.

21. ☐ A check in the amount of $ ______ to cover the recordal fee is enclosed.

22. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 06-1205:

a. ☒ Fees required under 37 CFR 1.16.

b. ☐ Fees required under 37 CFR 1.17.

c. ☐ Fees required under 37 CFR 1.18.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED	
NAME	Scott D. Malpede, Reg. No. 32,533
SIGNATURE	Scott D. Malpede
DATE	June 1, 1999

F511\W183478\SEW\SDM\mj

SCANNING EXPOSURE METHOD AND APPARATUS, AND DEVICE MANUFACTURING METHOD USING THE SAME

FIELD OF THE INVENTION AND RELATED ART

This invention relates generally to an exposure apparatus usable in a lithographic process, for example, for a semiconductor device or liquid crystal device. More particularly, the invention is concerned with a scan type exposure apparatus wherein a pattern formed on an original is transferred to a substrate to be exposed by relatively moving the original and the substrate relative to a projection optical system.

Exposure apparatuses for use in manufacture of semiconductor devices, for example, are currently represented by a step-and-repeat type exposure apparatus (stepper) wherein a substrate (wafer or glass plate9 to be exposed is moved stepwise so that a pattern of an original (reticle or mask) is printed on different exposure regions on the substrate in sequence and by sequential exposures with use of a projection optical system, and a step-and-scan type exposure apparatus (scan type exposure apparatus) wherein, through repetitions of stepwise motion and scanning exposure, lithographic transfer is repeated to different regions on a substrate. Particularly, in scan type exposure apparatuses, since only a portion

of a projection optical system close to its optical axis is used with restriction by a slit, higher precision and wider picture-angle exposure of a fine pattern can be accomplished. It will therefore become the main stream.

In conventional scan type exposure apparatuses, usually, global alignment procedure is made by using an off-axis alignment scope which is disposed in a scan axis direction as viewed from the optical axis of a projection optical system and, after moving a wafer to an exposure start point below the projection optical system (along the scan axis direction), stepwise motion and scanning exposure in regard to a next shot are repeated. In the movement or scanning motion of the wafer, laser interferometers are used to measure the position y of a wafer stage in the scan axis direction (hereinafter, Y direction) and the position x with respect to a direction (hereinafter, X direction) along a horizontal plane and being perpendicular to the scan axis direction as well as rotation θ (yawing) around a vertical axis (hereinafter, Z axis). On the basis of measured data, the wafer stage is servo-controlled. Usually, the yawing measurement for this servo-control is performed only in respect to a single direction, i.e., the scan axis direction.

SUMMARY OF THE INVENTION

The inventors of the subject application have found that: the yawing measurement data will theoretically be the same regardless that the measurement is made with respect to X direction or Y direction; comparing the results when yawing measurement in a scan type exposure apparatus is made in respect to X direction and when it is made in respect to Y direction, synchronization precision during scan is deteriorated where the yawing measurement is made in respect to X direction while overlay precision based on alignment precision in superposed printing is deteriorated where the yawing measurement is made in respect to Y direction, both as compared with a case where the stage servo control is made on the basis of the yawing measured value, measured with respect to the other direction, i.e., Y direction or X direction.

It is an object of the present invention to improve the performance of a scan type exposure apparatus such as synchronization precision in scan or overlay precision in superposed printing.

In accordance with an aspect of the present invention, there is provided a scan type exposure apparatus, wherein a pattern is transferred sequentially to different regions of a substrate through a step-and-scan operation including a

combination of stepwise motion of the substrate to an original and scanning exposure, moving the original and the substrate in a Y direction, said apparatus comprising: a stage for carrying a substrate thereon and being movable in the Y direction and an X direction orthogonal thereto; first measuring means for measuring yawing of said stage by using a first reflection surface along the Y direction of a mirror mounted on said stage; and second measuring means for measuring yawing of said stage by using a second reflection surface along the X direction of a mirror mounted on said stage.

In one preferred form of this aspect of the present invention, said first and second measuring means include laser interferometers for projecting laser beams to the same reflection surface and for performing interference measurement based on reflected laser beams. One of the laser interferometers may be used in the first measuring means as an X-direction laser interferometer for measuring the stage position with respect to X direction, and also used in the second measuring means as a Y-direction laser interferometer for measuring the stage position with respect to Y direction.

The stage movement may be servo controlled in accordance with the yawing measurement through the first or second measuring means. The first and second

measuring means may be selectively used in accordance with the state of operation of the exposure apparatus. For example, for scanning exposure in which scan is made in Y direction, the stage position measurement may be made by use of a Y-direction laser interferometer, a Y yawing measurement interferometer and an X-direction laser interferometer. Namely, for the scanning exposure, the second measuring means may be used for the yawing measurement. An alignment scope for performing an off-axis alignment measurement to the substrate may be used and, in that occasion, for the movement after the measurement by the alignment scope, the yawing measurement may be performed by use of the measuring means which is related to a direction orthogonal to the movement direction. Namely, when the measurement position of the alignment scope upon the stage is placed in Y direction as viewed from the optical axis of the projection optical system, for the movement after measurement by the alignment scope, the yawing measurement may be performed by use of the first measuring means, whereas when the measurement position of the alignment scope is placed in X direction as viewed from the optical axis of the projection optical system, the yawing measurement may be performed by use of the second measuring means.

For the selective operation of the first and

second measuring means, while they may be selectively operated in accordance with the state of operation of the exposure apparatus as described above, one of the measurement data of the them may be made effective. Alternatively, the measurement data of the first and second measuring means may be used through averaging processing or statistical processing.

In accordance with another aspect of the present invention, there is provided a scanning exposure method, comprising the steps of: preparing an original and a substrate; measuring a position of the substrate by use of an alignment scope and, after the measurement, moving the substrate; and sequentially transferring a pattern of the original to different regions on the substrate in accordance with a step-and-scan operation including a combination of stepwise motion of the substrate relative to the original and scanning exposure while moving the original and the substrate; wherein, between the scanning exposure and the movement after measurement by the alignment scope, a measurement direction with respect to which yawing measurement to a stage using a laser interferometer is made different. For example, for the scanning exposure, the stage yawing measurement may be performed by projecting laser beams in a direction the same as the scanning movement direction, while, for movement after the measurement by the alignment scope,

the stage yawing measurement may be performed by projecting laser beams in a direction orthogonal to the movement direction.

In accordance with a further aspect of the present invention, there is provided a scanning exposure method, comprising the steps of: preparing an original and a substrate; measuring a position of the substrate by use of an alignment scope and, after the measurement, moving the substrate; and sequentially transferring a pattern of the original to different regions on the substrate in accordance with a step-and-scan operation including a combination of stepwise motion of the substrate relative to the original and scanning exposure while moving the original and the substrate; wherein, for the scanning exposure, yawing measurement to a stage is performed by using a laser interferometer and in relation to a direction the same as the scanning movement direction, and wherein, for the movement after measurement by the alignment scope, yawing measurement to the stage is performed by using a laser interferometer and in relation to a direction orthogonal to the movement direction.

The inventors of the subject application have found that, in a scan type exposure apparatus, the flatness and orthogonality of bar mirrors for interferometer measurements have the following influences:

(1) When stage servo control is made in respect to the yawing direction on the basis of an interferometer having a measurement axis orthogonal to the scan axis, the flatness of a bar mirror leads to stage external disturbance, causing degradation of synchronization precision during the scan.

(2) Where automatic global alignment (AGA) is performed by use of an off-axis alignment scope which is positioned in the scan axis direction as viewed from a projection optical system, as in conventional systems, and when stage servo control is made in the yawing direction on the basis of an interferometer in the same direction as the scan axis, a change in orthogonality of bar mirrors between the AGA operation and the scanning exposure operation will cause degradation of overlay precision. This is because of a shift corresponding to the baseline (distance between the alignment scope position and the optical axis of the projection optical system) as multiplied by the change in orthogonality ($\sin\Delta\theta$).

In accordance with the present invention, there are yawing measuring means in relation to both of X and Y directions, and they may be used selectively in accordance with the state of operation of the exposure apparatus. This enables significant improvements of various performances, such as overlay precision and synchronization precision.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a scan type exposure apparatus according to an embodiment of the present invention.

Figure 2 is a perspective view of a scan type exposure apparatus according to another embodiment of the present invention.

Figure 3 is a flow chart for explaining microdevice manufacturing processes.

Figure 4 is a flow chart for explaining a wafer process included in the procedure of Figure 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a scan type exposure apparatus according to an embodiment of the present invention. Denoted in the drawing at 1 is a reticle, and denoted at 3 is a wafer. Denoted at 2 is a projection optical system for projecting a pattern of the reticle 1 onto the wafer 3. Denoted at 4 is a wafer stage for performing X-Y drive and tilt drive of the wafer 3,

and denoted at 5 is a stage base on which the wafer stage 4 is mounted. Denoted at 6 is a Y-direction laser interferometer for measuring the position y in Y direction (Y coordinate) of the wafer 3 by using a laser beam related to the Y direction. Denoted at 7 is a Y yawing measurement interferometer (second yawing measuring means) for detecting any rotation (yawing) θy about Z axis as the wafer stage 4 moves, in cooperation with the Y-direction laser interferometer 6 and by using the Y-direction laser beam. Denoted at 8 is an X-direction laser interferometer for measuring X-coordinate x of the wafer 3 by use of a laser beam related to the X direction. Denoted at 9 is an X yawing measurement interferometer (first yawing measuring means) for detecting any rotation (yawing) θx about Z axis as the wafer stage 4 moves, in cooperation with the X-direction laser interferometer 8 and by using the X-direction laser beam.

Denoted at 10 is a Y bar mirror having a second reflection surface along the X direction, for reflecting laser beams from the Y-direction laser interferometer 6 and the Y yawing measurement interferometer 7. Denoted at 11 is an X bar mirror having a first reflection surface along the Y direction, for reflecting laser beams from the X-direction laser interferometer 8 and the X yawing

measurement interferometer 9. These two bar mirrors 10 and 11 may be provided by a single mirror member with orthogonal reflection surfaces (having the function of X and Y bar mirrors), without separating them. Denoted at 12 is an off-axis alignment scope for performing off-axis wafer alignment. Denoted at 20 is a control unit for controlling various units of this embodiment as described above, and the control unit is communicated with these units via communication lines, not shown. The control unit 20 may be provided by a computer controlled system. Various functions of this embodiment may be performed in accordance with programs stored in the control unit 20. Denoted at A is the scan direction of the reticle 1 for the scanning exposure operation. Denoted at B is the scan direction of the wafer 3. Denoted at θ is the yawing direction of the stage 4. Idealistically, there is a relation $\theta y = 0 = \theta x$.

In the exposure apparatus illustrated, the alignment scope 12 is disposed in the scan direction (Y direction) of the projection optical system 2 and, as compared with conventional scan type exposure apparatuses wherein the yawing measurement to the stage 4 is performed in the scan axis direction and by using the Y-direction laser interferometer 6 and the Y yawing measurement interferometer 7, there is X yawing measurement interferometer 9 added which is operable

to perform yawing measurement to the stage 4 in X direction in cooperation with the X-direction laser interferometer 8. During the scan exposure operation, as conventional, the yawing measurement is performed in Y direction by using the laser interferometers 6 and 7, whereas for the global alignment (AGA) operation, it is performed in X direction by using the laser interferometers 8 and 9. The two laser interferometer systems are selectively used in this manner.

Thus, during scan operation, the Y bar mirror 10 functions to perform yawing measurement approximately at a constant position. Thus, there is small influence of the flatness of the bar mirror, and the synchronization precision is not degraded. For the global alignment operation, there is small influence of the orthogonality of the X bar mirror 11 to the Y bar mirror 10 and, therefore, the overlay precision is improved as compared with that of conventional scan type exposure apparatuses.

Further, in the exposure apparatus of Figure 1, in the states of operation other than the alignment operation or scanning operation, measurement may be performed on the basis of a side more convenient to the state of operation being done, or the yawing measured data more convenient may be used selectively. As a further alternative, both of the measured data

may be used on the basis of averaging processing or through statistical processing. The measuring means may be used selectively, in this manner.

Figure 2 shows a scan type exposure apparatus according to another embodiment of the present invention. Those components corresponding to that of the Figure 1 embodiment are denoted by like numerals. In the exposure apparatus of Figure 2, as compared with conventional apparatuses described above, the position of the alignment scope 12 with respect to the projection optical system 2 is placed in X direction (Figure 2), this being to be contrasted to Y direction in the conventional structure. With this arrangement, the movement direction in the alignment direction is laid on X direction which is orthogonal to the scan axis direction (Y direction). Even though the same laser interferometers 6 and 7 are used for yawing measurement in Y direction, the yawing measurement direction (Y direction) in alignment operation is preferably laid on a direction orthogonal to the movement direction (X direction). As a result, without degradation of synchronization precision, the overlay precision can be improved.

In the exposure apparatus of Figure 2, there is an X yawing measurement interferometer 9 added, for performing yawing measurement to the stage 4 in X direction, in cooperation with the X-direction laser

interferometer 8. In accordance with the state of operation other than the alignment operation or scan operation, the yawing data measured with respect to the direction convenient may be selected or the measurement may be switched. Alternatively, both of the yawing measured data may be used through averaging processing or statistical processing.

Next, an embodiment of a device manufacturing method which uses an exposure apparatus as described above, will be explained.

Figure 3 is a flow chart of procedure for manufacture of microdevices such as semiconductor chips (e.g. ICs or LSIs), liquid crystal panels, CCDs, thin film magnetic heads or micro-machines, for example.

Step 1 is a design process for designing a circuit of a semiconductor device. Step 2 is a process for making a mask on the basis of the circuit pattern design. Step 3 is a process for preparing a wafer by using a material such as silicon. Step 4 is a wafer process which is called a pre-process wherein, by using the so prepared mask and wafer, circuits are practically formed on the wafer through lithography. Step 5 subsequent to this is an assembling step which is called a post-process wherein the wafer having been processed by step 4 is formed into semiconductor chips. This step includes assembling (dicing and

bonding) process and packaging (chip sealing) process. Step 6 is an inspection step wherein operation check, durability check and so on for the semiconductor devices provided by step 5, are carried out. With these processes, semiconductor devices are completed and they are shipped (step 7).

Figure 4 is a flow chart showing details of the wafer process.

Step 11 is an oxidation process for oxidizing the surface of a wafer. Step 12 is a CVD process for forming an insulating film on the wafer surface. Step 13 is an electrode forming process for forming electrodes upon the wafer by vapor deposition. Step 14 is an ion implanting process for implanting ions to the wafer. Step 15 is a resist process for applying a resist (photosensitive material) to the wafer. Step 16 is an exposure process for printing, by exposure, the circuit pattern of the mask on the wafer through the exposure apparatus described above. Step 17 is a developing process for developing the exposed wafer. Step 18 is an etching process for removing portions other than the developed resist image. Step 19 is a resist separation process for separating the resist material remaining on the wafer after being subjected to the etching process.

By repeating these processes, circuit patterns are superposedly formed on the wafer. With

these processes, high density microdevices can be manufactured.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purposes of the improvements or the scope of the following claims.

WHAT IS CLAIMED IS:

1. A scan type exposure apparatus, wherein a pattern is transferred sequentially to different regions of a substrate through a step-and-scan operation including a combination of stepwise motion of the substrate to an original and scanning exposure, moving the original and the substrate in a Y direction, said apparatus comprising:

a stage for carrying a substrate thereon and being movable in the Y direction and an X direction orthogonal thereto;

first measuring means for measuring yawing of said stage by using a first reflection surface along the Y direction of a mirror mounted on said stage; and

second measuring means for measuring yawing of said stage by using a second reflection surface along the X direction of a mirror mounted on said stage.

2. An apparatus according to Claim 1, further comprising an alignment scope for performing off-axis alignment measurement to the substrate.

3. An apparatus according to Claim 2, wherein a measurement position of said alignment scope upon said stage is placed in the Y direction as viewed from an optical axis of said projection optical system.

4. An apparatus according to Claim 2, wherein a measurement position of said alignment scope upon said stage is placed in the Y direction as viewed from an optical axis of said projection optical system.

5. An apparatus according to Claim 1, further comprising control means for servo controlling motion of said stage on the basis of yawing measurement by one of said first and second measuring means.

6. An apparatus according to Claim 1, wherein said first and second measuring means include laser interferometers for projecting laser beams to the same reflection surface and for performing interference measurement based on reflected laser beams.

7. An apparatus according to Claim 1, wherein said first measuring means includes an X yawing measurement interferometer for performing yawing measurement to said stage in cooperation with an X-direction laser interferometer for measuring the stage position with respect to the X direction, and wherein said second measuring means includes a Y yawing measurement interferometer for performing yawing measurement to said stage in cooperation with a Y-direction laser interferometer for measuring the stage

position with respect to the Y direction.

8. An apparatus according to Claim 7, wherein, for scanning exposure, the position measurement to the stage is performed by use of the Y-direction laser interferometer, the Y yawing measurement interferometer, and the X-direction laser interferometer.

9. An apparatus according to Claim 1, further comprising selecting means for selective use of said first and second measuring means in accordance with the state of operation of said exposure apparatus.

10. An apparatus according to Claim 9, wherein said selecting means includes one of (i) first means effective to select one of the first and second measuring means to perform the measurement in accordance with the state of operation of said exposure apparatus, and (ii) second means operable to cause one of the measurement data of said first measuring means and the measurement data of said second measuring means effective.

11. An apparatus according to Claim 9, wherein said selecting means includes processing means for performing one of averaging processing and statistical

processing to the measurement data of said first and second measuring means in accordance with the state of operation of said exposure apparatus.

12. An apparatus according to Claim 1, wherein, for scanning exposure, the yawing measurement is performed by use of said second measuring means.

13. An apparatus according to Claim 12, wherein, for movement after the measurement with said alignment scope, the yawing measurement is performed by use of said first measuring means.

14. An apparatus according to Claim 1, wherein, for movement after the measurement with said alignment scope, the yawing measurement is performed by use of the measuring means which is related to a direction orthogonal to the movement direction.

15. A scanning exposure method, comprising the steps of:

preparing an original and a substrate;

measuring a position of the substrate by use of an alignment scope and, after the measurement, moving the substrate; and

sequentially transferring a pattern of the original to different regions on the substrate in

accordance with a step-and-scan operation including a combination of stepwise motion of the substrate relative to the original and scanning exposure while moving the original and the substrate;

wherein, between the scanning exposure and the movement after measurement by the alignment scope, a measurement direction with respect to which yawing measurement to a stage using a laser interferometer is made different.

16. A method according to Claim 15, wherein, for the scanning exposure, the stage yawing measurement is performed by projecting laser beams in a direction the same as the scanning movement direction.

17. A method according to Claim 16, wherein, for movement after the measurement by the alignment scope, the stage yawing measurement is performed by projecting laser beams in a direction orthogonal to the movement direction.

18. A scanning exposure method, comprising the steps of:

preparing an original and a substrate;

measuring a position of the substrate by use of an alignment scope and, after the measurement, moving the substrate; and

sequentially transferring a pattern of the original to different regions on the substrate in accordance with a step-and-scan operation including a combination of stepwise motion of the substrate relative to the original and scanning exposure while moving the original and the substrate;

wherein, for the scanning exposure, yawing measurement to a stage is performed by using a laser interferometer and in relation to a direction the same as the scanning movement direction, and wherein, for the movement after measurement by the alignment scope, yawing measurement to the stage is performed by using a laser interferometer and in relation to a direction orthogonal to the movement direction.

19. A device manufacturing method, for producing a device through a process based on a method as recited in any one of Claims 15 - 18.

20. A method according to Claim 19, further comprising applying a resist to a substrate before exposure thereof, and developing the resist after the exposure.

ABSTRACT OF THE DISCLOSURE

A scan type exposure apparatus in which a pattern formed on an original is transferred a substrate while relatively moving the original and the substrate relative to a projection optical system, wherein a stage is servo controlled on the basis of measurement of X and Y coordinates (x,y) and yawing component θ, and wherein yawing measuring systems provided in relation to X and Y directions are selectively used in accordance with the state of operation of the apparatus so that the yawing component measurement direction is laid on preferable one of the X and Y directions.

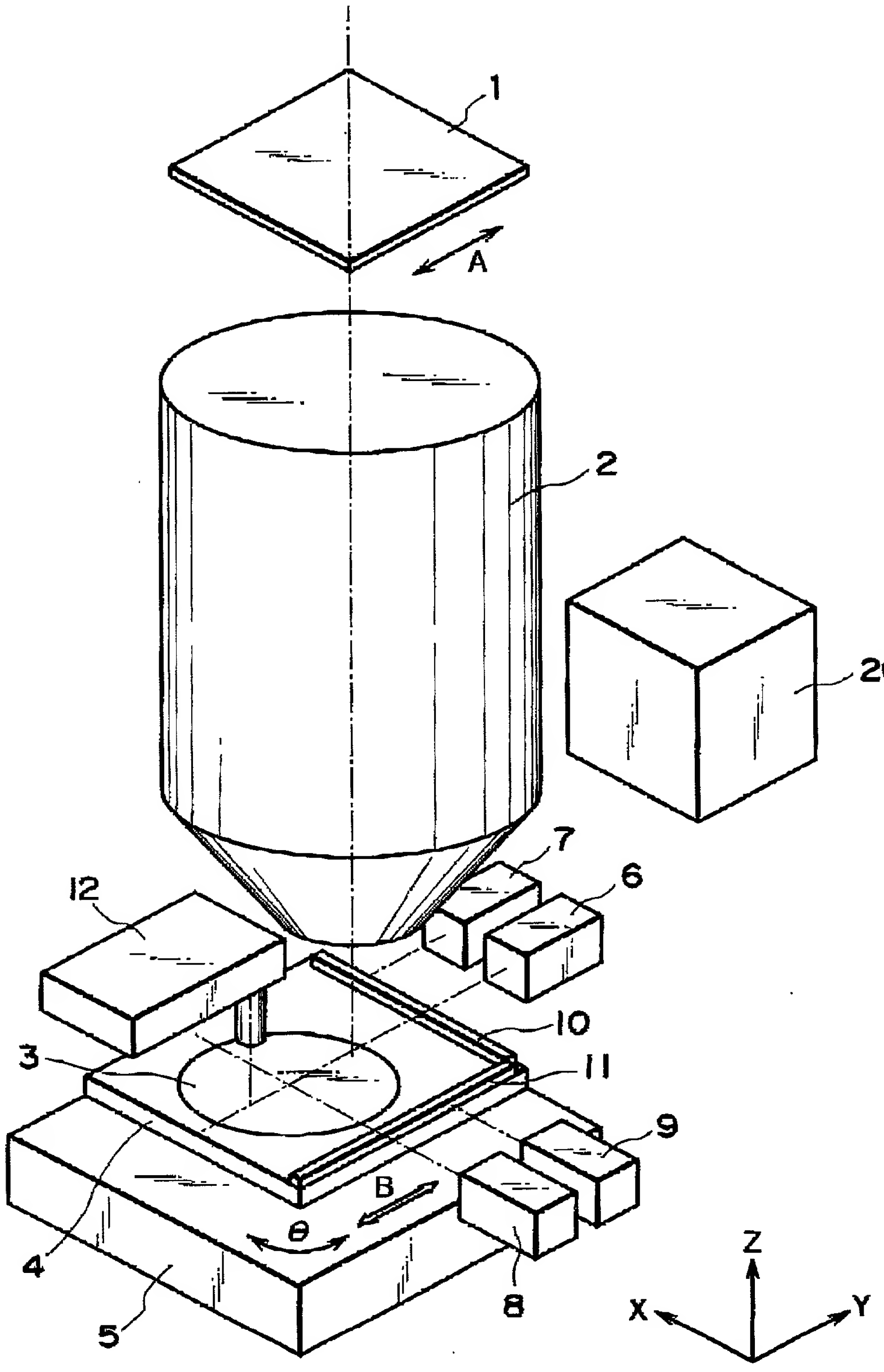

FIG. 1

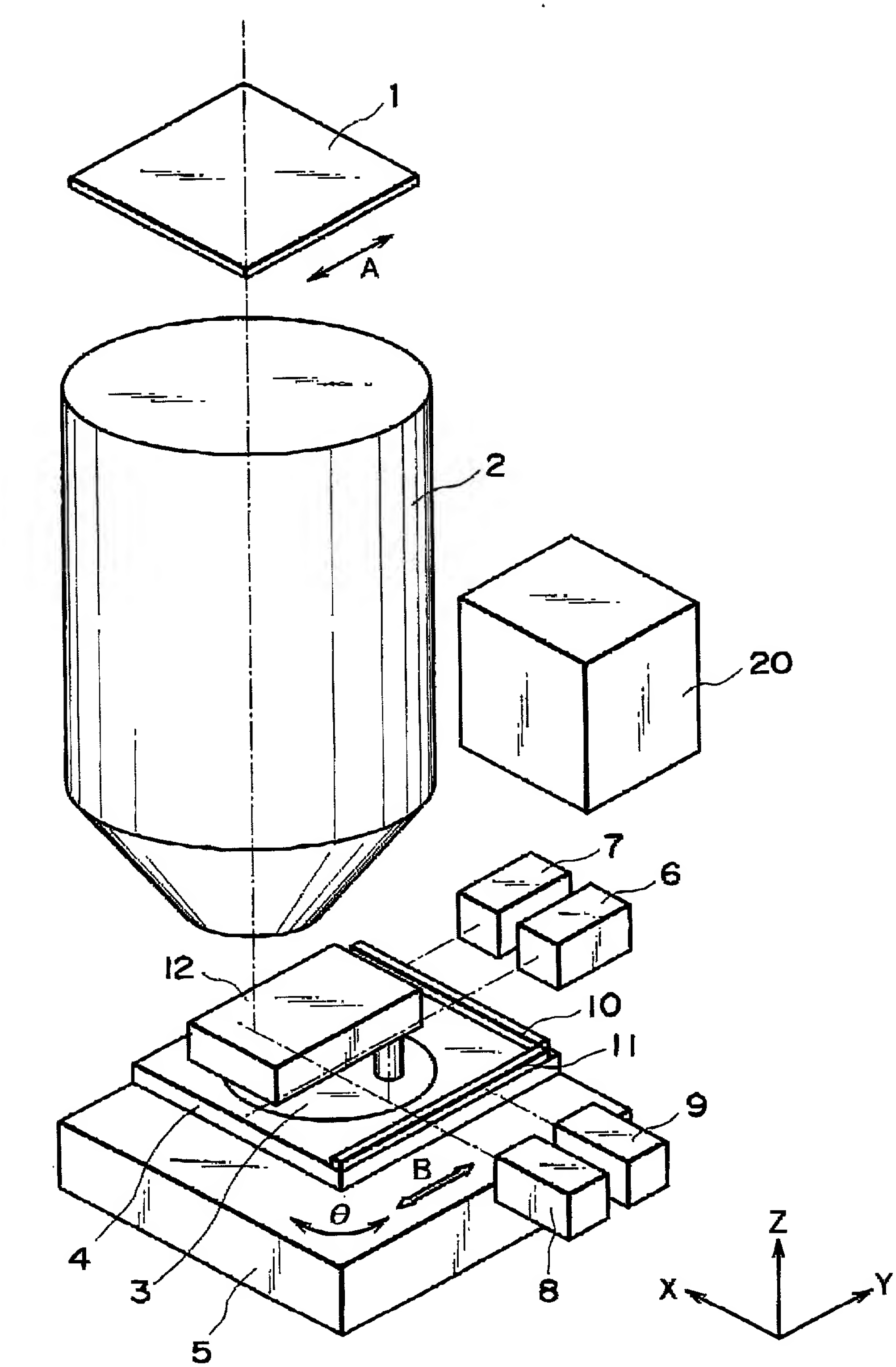

FIG. 2

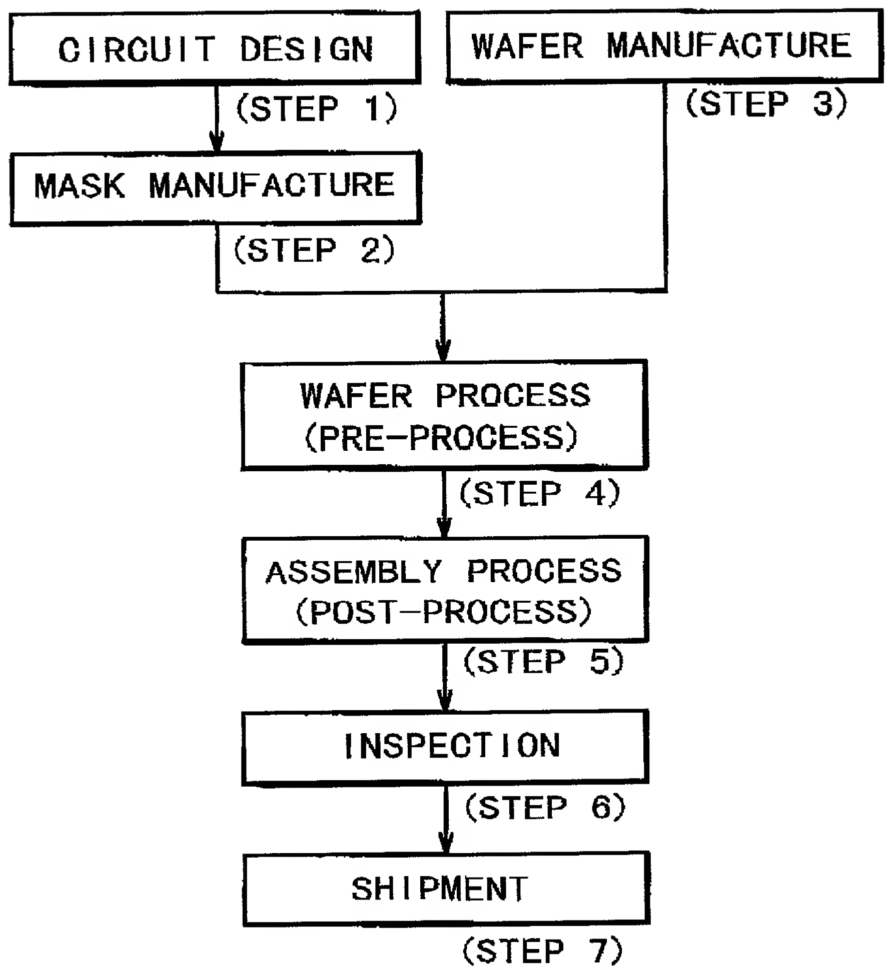
CIRCUIT DESIGN
WAFER MANUFACTURE
(STEP 1)
(STEP 3)
MASK MANUFACTURE
(STEP 2)
WAFER PROCESS
(PRE-PROCESS)
(STEP 4)
ASSEMBLY PROCESS
(POST-PROCESS)
(STEP 5)
INSPECTION
(STEP 6)
SHIPMENT
(STEP 7)

FIG. 3

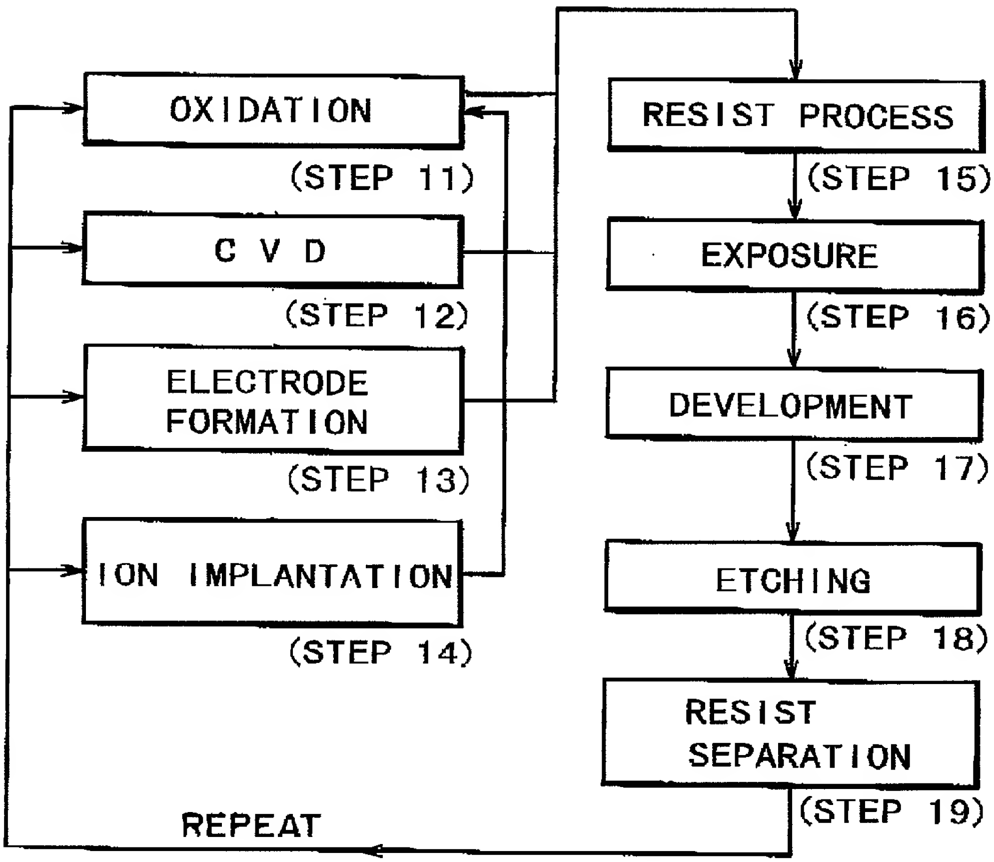
OXIDATION
(STEP 11)
C V D
(STEP 12)
ELECTRODE FORMATION
(STEP 13)
ION IMPLANTATION
(STEP 14)
RESIST PROCESS
(STEP 15)
EXPOSURE
(STEP 16)
DEVELOPMENT
(STEP 17)
ETCHING
(STEP 18)
RESIST SEPARATION
(STEP 19)
REPEAT

FIG. 4

COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

(Page 1)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled SCANNING EXPOSURE METHOD AND APPARATUS, AND DEVICE MANUFACTURING METHOD USING THE SAME,

the specification of which [X] is attached hereto [ ] was filed on ______ as United States Application No. or PCT International Application No. ______

and was amended on ______ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b), of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designates at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

Country	Application No.	Filed (Day/Mo./Yr.)	(Yes/No) Priority Claimed
Japan	10-167805	2/June/1998	Yes

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Application No.	Filed (Day/Mo./Yr.)	Status (Patented, Pending, Abandoned)

I hereby appoint the practitioners associated with the firm and Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to the address associated with that Customer Number:

FITZPATRICK, CELLA, HARPER & SCINTO
Customer Number: 05514

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole or First Inventor KAZUNORI IWAMOTO

Inventor's signature ______

Date ______ Citizen/Subject of JAPAN

Residence 2-25-15 Toyosatodai, Utsunomiya-shi, Tochigi-ken, Japan

Post Office Address c/o CANON KABUSHIKI KAISHA, 3-30-2, Shimomaruko, Ohta-ku, Tokyo, Japan

COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
(Page 2)

Full Name of Second Joint Inventor, if any NOBUYOSHI DEGUCHI

Second Inventor's signature ______

Date ______ Citizen/Subject of JAPAN

Residence 2734-6 Ohaza-Nakaokamoto, Kawachimachi, Kawachi-gun, Tochigi-ken, Japan

Post Office Address c/o CANON KABUSHIKI KAISHA, 3-30-2, Shimomaruko, Ohta-ku, Tokyo, Japan

F511\W183488\SEW\SDM\lmj